AP Statistics
Test: Inference for One- and Two-Way Tables and for Least-Squares
Instructor's Version

Free Response: 2 questions, 52 points, 30 minutes

1. This table shows the number of defects, tallied by day of the week, in a manufacturing process:

	Monday	Tuesday	Wednesday	Thursday	Friday
Number	36	23	26	25	40

The manufacturer is concerned that the number of defects is greater on Monday and Friday. Test, at the .05 level of significance, the claim that the proportion of defects is the same each day of the week. Be sure to include all steps of a hypothesis testing procedure. (26 points)

Answer:

H_0 : $p_1 = p_2 = p_3 = p_4 = p_5$ (The proportion of defects is the same each day of the week.)

H_a : At least one proportion is not equal to the others. (The proportion of defects is not the same each day of the week.) (7 points)

Since there are 150 total defects produced, we would expect 30 defects each day if the proportions were equal. This number of expected outcomes is large enough to justify use of the chi-square goodness-of-fit procedure. (7 points)

$X^2 = 7.533$, $df = 4 \rightarrow .10 < P < .15$ (Using the TI-83, $P = .11$.) (6 points)

Though the table's values may appear to be heavily weighted toward defects on Monday and Friday, we would get a list such as this by chance alone about 11% of the time, even if the proportion were the same each day of the week. This is not strong enough evidence to conclude that the proportion of defects is different on some days. (6 points)

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The data in the following MINITAB output refer to an automobile's stopping distance (in feet) at different speeds.

A. What's the equation of the regression line you'd use to predict stopping distance based on speed? (4 points)

Answer:
StopDist = –89.99 + 5.7053(Speed)

B. Interpret the slope of the regression line. (4 points)

Answer:
For each increase in speed of one mile per hour, the predicted increase in stopping distance is 5.7 feet.

C. Find a 95% confidence interval for the slope of the regression line. (4 points)

Answer:
$df = 8 \rightarrow t^* = 2.306$
$5.7053 \pm 2.306(.2707) = (5.08, 6.33)$

D. Test the hypothesis $H_0: \beta_1 = 0$ and $H_a: \beta_1 \neq 0$. (7 points)

Answer:
$H_0: \beta_1 = 0$ (The slope of the population regression line is 0.)
$H_a: \beta_1 \neq 0$ (The slope of the population regression line is different from 0.)
$t = \frac{5.7053}{.2707} = 21.08$, $df = 8 \rightarrow P = 0$
This low *P*-value tells us that there is almost no chance of obtaining a *t* value this large if the slope were actually zero. Therefore we reject the null hypothesis and conclude that the slope of the regression line differs from 0. This is strong evidence that stopping distance can be predicted, using a linear model, from speed.

E. Suppose, instead of testing $H_0: \beta_1 = 0$, you decided to test $H_0: \beta_1 = 5$ against $H_a: \beta_1 \neq 5$. What *P*-value would be associated with this test? (7 points)

Answer:
$t = \frac{5.7053 - 5}{.2707} = 2.605$, $df = 8 \rightarrow 2(.01) < P < 2(.02) \rightarrow .02 < P < .04$
($P = .031$ from the TI-83 Distribution Menu.)

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